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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/717,122	11/19/2003	Larry Zhao	2000.106900	7303
23720	7590	01/13/2006		
WILLIAMS, MORGAN & AMERSON 10333 RICHMOND, SUITE 1100 HOUSTON, TX 77042			EXAMINER GHYKA, ALEXANDER G	
			ART UNIT	PAPER NUMBER
			2812	

DATE MAILED: 01/13/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/717,122

Applicant(s)

ZHAO ET AL.

Examiner

Alexander G. Ghyska

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☐ Responsive to communication(s) filed on ____.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 10-38 is/are pending in the application.
- 4a) Of the above claim(s) ____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) ____ is/are allowed.
- 6) ☒ Claim(s) 10-38 is/are rejected.
- 7) ☐ Claim(s) ____ is/are objected to.
- 8) ☐ Claim(s) ____ are subject to restriction and/or election requirement.

ALEXANDER GHYKA
PRIMARY EXAMINER

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Alex Ghyska

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 19 November 2003 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. ____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- ☐ Notice of References Cited (PTO-892)
- ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date ____.
- ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date ____.
- ☐ Notice of Informal Patent Application (PTO-152)
- ☐ Other: ____.

DETAILED ACTION

The Applicants' response of 11/09/2005 has been considered and entered in the record. New Claims 32-38 are added. Claims 10-38 are now under consideration. The Applicants' arguments have been considered, but they are not persuasive for the reasons as discussed below. New Claims 32-38 are rejected for the reasons as discussed below.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

Claims 10-31 are rejected under 35 U.S.C. 102(e) as being anticipated by Rajagopalan (US 6,656,840) for the reasons as discussed in the previous Office action.

The present claims generally require forming a first silicon nitride layer on an exposed copper surface; and forming a second silicon nitride layer on the first silicon nitride layer while adjusting a silicon concentration of the second silicon nitride layer to be higher than that of the first silicon nitride layer.

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Rajagolan et al disclose forming a copper structure on a surface; forming a first layer which comprises a silicon nitride layer; and forming a second silicon nitride layer wherein the the atomic ratio of nitrogen to silicon in the first layer is greater than the atomic ratio of nitrogen to silicon in the second layer, or in other words the second layer is silicon rich. See column 14, lines 30-40. Rajagolan et al disclose the nitride layers are formed using plasma enhanced chemical vapor without interrupting vacuum as required by present Claim 11. See Example, column 13-14 and column 14, lines 45-50. Moreover, Rajagolan et al discloses using silane and nitrogen without ammonia to form the first layer, and silane and nitrogen without ammonia to form the second nitride layer, wherein the molar ratio of nitrogen to silane in the first layer is greater than the nitrogen to silane in the second layer, as required by present claims 12-17. See the Example on columns 13-14 and column 14, lines 53-60. Ammonia can be used in forming the second layer. See column 11, lines 20-45. Rajagolan also discloses thicknesses of the layers as required by Claims 18-19. See column 5, lines 25-35. The formation of the second layer inherently stops the formation of the first layer as required by claims 23-26. Furthermore, the plasma is not interrupted as required by claims 27-31. See columns 13-14, the Example. Therefore, Claims 10-31 are anticipated by Rajagolan et al.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

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(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

Claims 32-38 are rejected under 35 U.S.C. 103(a) as being unpatentable over Rajagopalan (US 6,656,840).

Claims 32-38 further requires a deposition process for forming a first nitride layer comprising a silane flow rate of approximately 120-170 sccm and a nitrogen flow rate of approximately 220-330 sccm; and forming a second silicon nitride layer by performing a deposition process comprising a silane flow rate of approximately 200-250 sccm and a nitrogen flow rate of approximately 30-80 sccm.

Rajagopalan et al is relied upon as discussed above.

However, Rajagopalan does not disclose the claimed flow rates as required in the present claims.

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It would have been obvious to one of ordinary skill in the art, at the time of the invention, to arrive at the flow rates as required by the present claims, as Rajagopalan disclose the same process, silicon nitride formation, using the same reactants, silane and nitrogen, and the use of optimum flowrates for the known reactants would be within the level of one of ordinary skill in the art. Where the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation. See *Allen et al v. Coe*, 57 USPQ 136. Moreover, the discovery of an optimum variable in a known process is ordinarily within the skill in the art. See *In re Antonie*, 195 USPQ 6, (CCPA 1977); *In re Aller* 105 USPQ 233 (1955). In the present case the determination of the optimum flowrates for the reactants would be a matter of optimization for one of ordinary skill in the art, and therefore a *prima facie* case of obviousness is established

Response to Applicants' Arguments

Applicants argue that all pending claims require that the concentration of silicon in the second nitride layer is greater than the concentration of silicon in the first silicon nitride layer. Applicants further argue that Rajagopalan discloses that the gas flow rates of one or both of the process gases may be adjusted to achieve the desired atomic ratios in the first and second layers, and that Rajagopalan is simply not concerned with the absolute amounts of silicon in the first and second layers and is simply concerned with the relative atomic ratios of the element (nitrogen) to silicon in each of the layers. The Examiner maintains

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that a greater atomic ratio of an element would result in a greater in a greater concentration. The Examiner further notes that Rajagopalan et al clearly states that "the first layer is adjacent to the conductive structure and has a lower silicon concentration than the second layer". See column 6, lines 34-38. Therefore, the Claims are not patentable in view of the Rajagopalan et al reference.

Conclusion

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Alexander G. Ghyka whose telephone

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number is (571) 272-1669. The examiner can normally be reached on Monday through Thursday during general business hours.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Michael Lebentritt can be reached on (571) 272-1873.

The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

AGG
January 11, 2006

ALEXANDER GHYKA
PRIMARY EXAMINER

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